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Editorial

Advances in Characterization and Modeling of Nanoreinforced Composites

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Exceptional mechanical, electrical, and thermal properties of nanoreinforced materials as well as their low density and high aspect ratios have now rendered them among desired reinforcing agents in a wide range of composites in high tech applications. The experimental measurement of nanoreinforced material properties, however, is still a challenging and tedious task. Extremely scattered data obtained through experimental observations, which often originated from different processing limitations, have led many researchers to pursue also analytical studies on the effective properties of nanoreinforcements and their corresponding composites. Consequently, next to experimental investigations, simulation and modeling techniques currently play a significant role in characterizing nanocomposites properties and understanding their mechanical behavior via atomistic modeling, continuum mechanics-based approach, and multiscale modeling techniques, among others.

Characterization of nanocomposites is often aimed at gaining knowledge on their global response, such as the macrodisplacement and stress fields at boundaries of a representative volume element. The continuum mechanics approaches are known to be adequate and sufficient for modeling nanocomposites within this scope. However, for more elaborated and in-depth analyses, the multiscale modeling techniques may be considered where the molecular dynamics and continuum mechanics models are integrated in a virtual computing environment. This approach would be detailed enough to account for the material physics at nanoscale, while efficient enough to handle the field variables of interest at larger length scales.

This special issue deals with a range of recently developed characterization and modeling techniques employed to better understand and predict the response of nanoreinforced composites at different scales.

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